Spin Database Quality Assurance for Run12

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Abstract

In this note we document our studies to ensure that the spin database accurately tracks spin related quantities essential to spin analysis. Included in the note are a list of runs which passed our QA procedure. Analyzers studying runs outside of this list do so at their own peril.

Contents

1 Introduction

The following note documents the quality assurance procedure run over the run12pp200 and run12pp510 spin database entries. An important input to the analysis is a runlist. We took as input all runs available on the analysis taxi for the two datasets. This runlist is available in:

`offline/analysis/koster/chkSpinDB/`

along with other source code used in this analysis. It should be noted that runs not included in our runlist were not included in the analysis.

    An important note is that analyzers should perform their own quality assurance check on the spin database. One of the most simple and important checks is to verify that when they plot their experimental yield, e.g. number of J/Ψ's, versus the crossing id, the crossings with high yields should line up with filled-filled crossings and the crossings with low yields should line up with unfilled-unfilled crossings. It is an extremely simple check but also a very important one.

2 Cross-checks

The following cross-checks of the spin database were performed:

1. Confirm that information exists in the database.

2. Polarization values in the spin database match the official released values.

3. The spin patterns and crossing shifts are consistent between all runs within a given fill.

4. For each run, the scaler values match up to their respective GL1p scaler values.

Details on each check are given in the subsections below. Code to perform these checks is available in:

`offline/analysis/koster/chkSpinDB`

2.1 Data availability

The following runs do not have information available for them in the database.

358661 358663 358665 358667 359060 359061 359062 359064 362260

All of these runs occurred in the 200 GeV portion of the run.

2.2 Polarization

The official polarization values are taken from ref. [1]. The polarimetry group did not release official polarization values for some fills. These fills are summarized in table 1. For run12, the spin database follows the custom of entering these polarization values as -999. Analyzers should take care not to inadvertently include these polarization values in their analysis.

Fill	$\sqrt{s}$	Comment
16347	200	Yellow not available
16357	200	Yellow not available
16387	200	Yellow not available
16456	200	Blue not available
16481	200	Yellow not available
16525	200	Yellow not available
16541	200	Yellow not available
16715	510	Yellow not available

Table 1: List of fills from Run12 with missing polarization values

All polarizations and associated statistical errors are found to match between the database and the official source. However, systematic errors on the polarization values are up to each analyzer to include, as appropriate, in their final result.

2.3 Spin pattern

For each run, we check that the spin-pattern and crossing-shift are self-consistent with all other runs from within its fill. The fills that had inconsistent spin patterns are summarized in table 2. It should be noted that several of the fills with inconsistent spin patterns between their constituent runs, are in fact correct. This source of this inconsistency is the alignment of our crossing id to the spin pattern. Where noted, cross-checks have been performed to ensure that the spin pattern aligns with experimental yields.

Fill	$\sqrt{s}$	Runs	Comment
16426	200	358985 358986 358988 358991 358992 358996 358997 358998 359002	Runs listed in red font color had a crossing-shift of 120; runs in black have the usual crossing-shift of 5. Several DST's were downloaded to check if the two different crossing-shifts are present in experimental yields. Two crossing-shifts are present in the data, as shown in figure 1. Therefore, the crossing-shifts noted in the database are accurate. However, the 120 was changed to zero. In addition, it was noted that the GL1p yields were improperly aligned to the spin pattern when the data was initially entered. The GL1p error was corrected.
16462	200	360473 360474 360475	The spin-pattern polarity swapped midway through the fill. See figures 2-6 for evidence. This data was taken during the 200 GeV transverse running period, when the local polarimeter scaler asymmetry is expected to be around 2%. For the runs highlighted in red, the asymmetry was the correct magnitude but the wrong sign.
16697	510	367538 367543 367545 367546 367548 367549 367552	Crossing shift problem. Runs highlighted in red had a spin pattern misaligned to the experimental yields. The crossing shift was set from 120 to 5 to correct this problem.
16698	510	367593 367594 367596 367597 367598 367600 367601 367602	Crossing shift problem. Runs highlighted in red had a spin pattern misaligned to the experimental yields. The crossing shift was set from 120 to 5 to correct this problem.

Table 2: List of fills from Run12 whose constituent runs had either non-identical spin patterns or non-identical crossing shifts. Runs highlighted in red had their spin-patterns and/or crossing-shifts changed to match those from the runs in black.

2.3.1 Fill 16426

The following discussion provides some more detail on the spin database entries corresponding to fill 16426. To check if the crossing-shift entered in the database is correct, several DST's were downloaded and a simple Fun4All code ran over each one to check for the experimental yields. The method used to check the crossing id is:

```
TrigLvl1::get_lvl1_clock_crossing()
```

The output experimental crossing distributions are shown in figure 1. The conclusion is clear: the crossing-shift difference is real and the four runs with a crossing-shift of 0 instead of the standard 5 will need special attention. In particular, an analysis using either the MPC or EMC should realize that the PPG event likely fired on crossings with physics collisions instead of the usual timing during the abort gap. Contact a timing expert such as Mickey Chiu or John Haggerty for a detailed explanation.

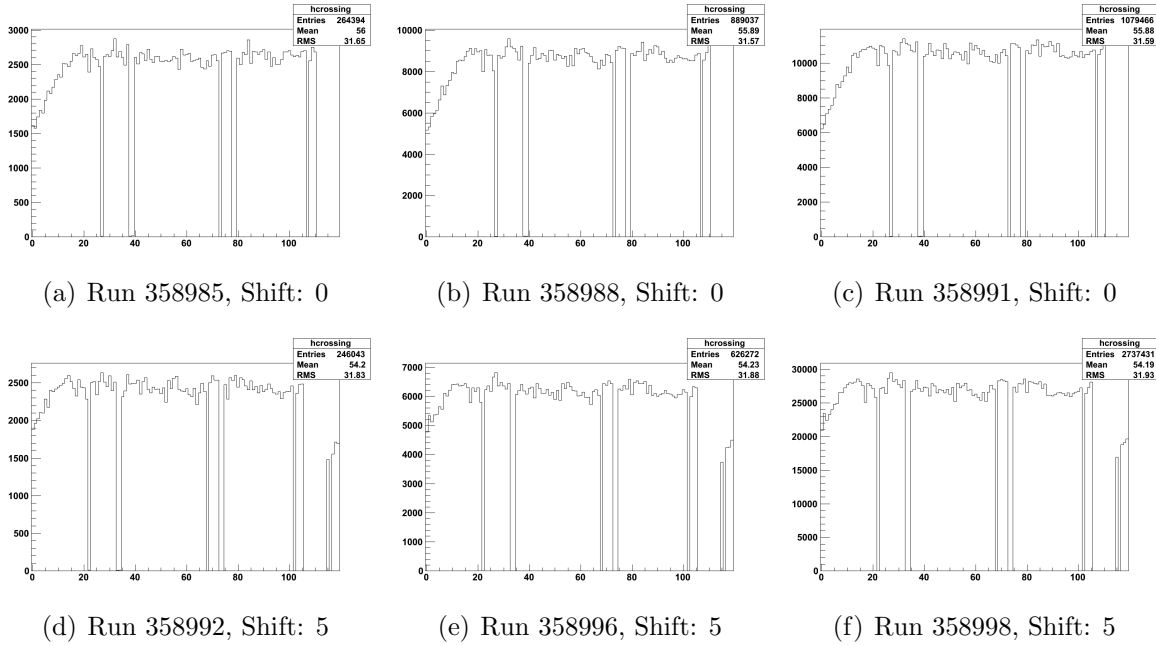|		
(a) Run 358985, Shift: 0	(b) Run 358988, Shift: 0	(c) Run 358991, Shift: 0
(d) Run 358992, Shift: 5	(e) Run 358996, Shift: 5	(f) Run 358998, Shift: 5

Figure 1: Distribution of experimental counts versus crossing for various runs within fill 16426. The experimental yields clearly differ in behavior for the fills with a crossing-shift of 0 versus 5.

2.3.2 Fill 16462

The following discussion provides some more detail on the spin pattern for fill 16462 since correcting its spin database entries required some analysis. This fill was at $\sqrt{s}$=200 GeV and transverse polarization. Because the beam is polarized transversely we have a well-defined expectation for both the sign and magnitude for the raw asymmetry in the local polarimeter scalers. This expected behavior is shown in fig. 2 for fill 16461. Fill 16462, the next fill, starts normally with runnumber 360473 (fig. 3), but the next two runs,

runnumbers 360474 and 360475, have asymmetries with the wrong sign (fig. 4 and 5). For the following fill, fillnumber 16463, the local polarimeter asymmetry's sign returns to its expected positive value. The spin pattern polarity of runs 360474 and 360475 was flipped in order to match the spin pattern from run 360473.
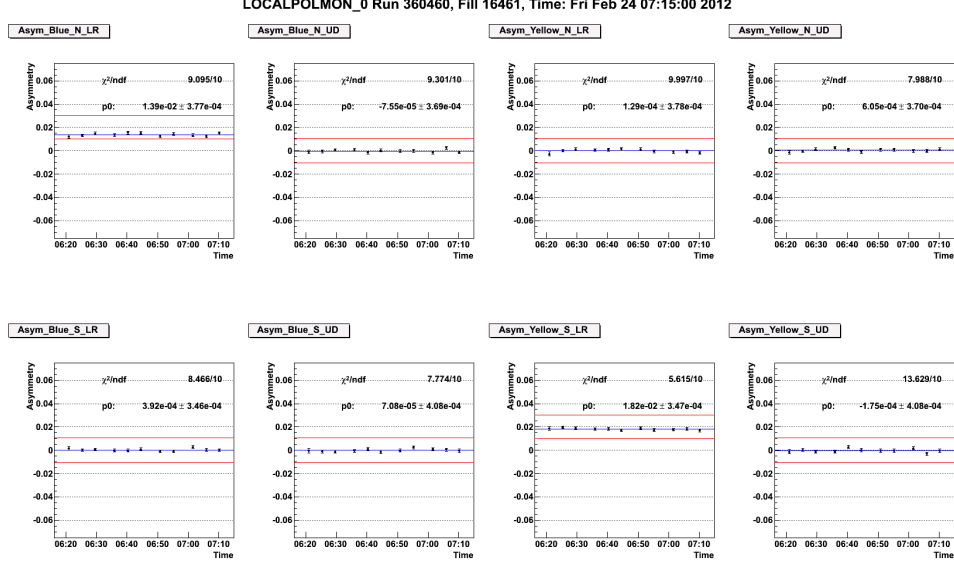

Figure 2: Local polarimetry data from fill: 16461, runnumber: 360460. An example of the expected behavior in the local polarimeter monitor: the left/right asymmetries in the forward direction are non zero and positive while all other asymmetries are consistent with zero.
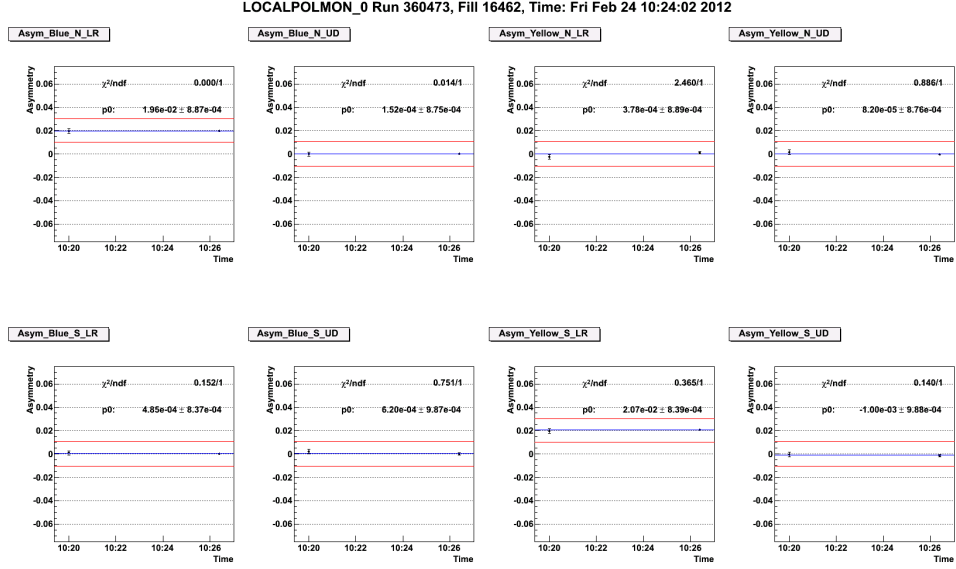
Figure 3: Local polarimetry data from fill: 16462, runnumber: 360473. The first run the fill with strange behavior. The data from this run matches our expectations.
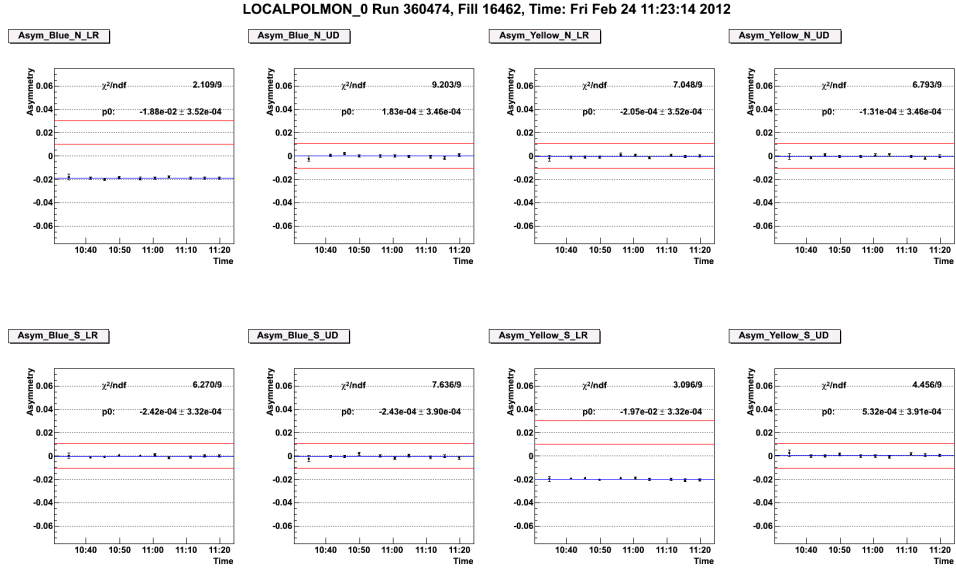

Figure 4: Local polarimetry data from fill: 16462, runnumber: 360474. The first run with a local polarimeter asymmetry with an incorrect sign.
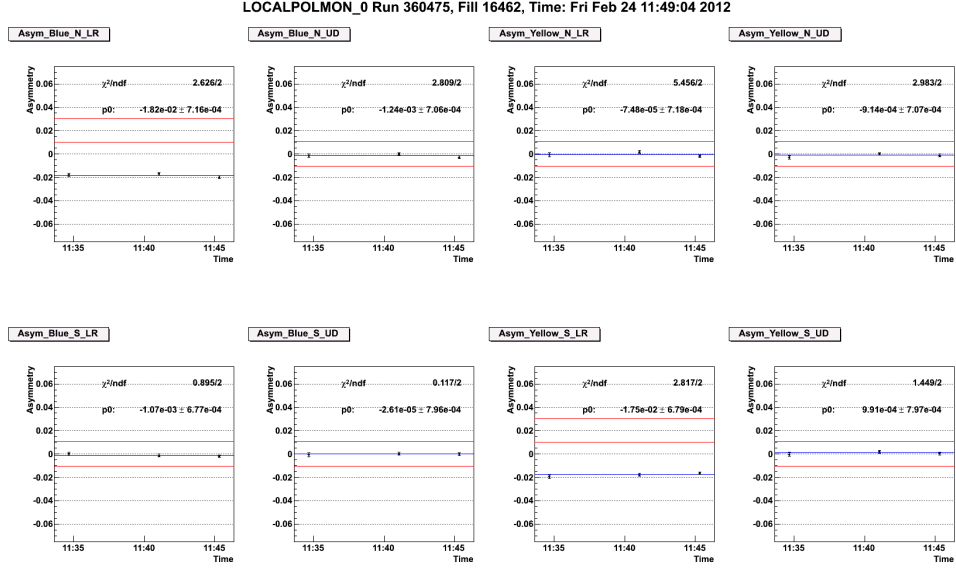
Figure 5: Local polarimetry data from fill: 16462, runnumber: 360474. The second run with a local polarimeter asymmetry with an incorrect sign.
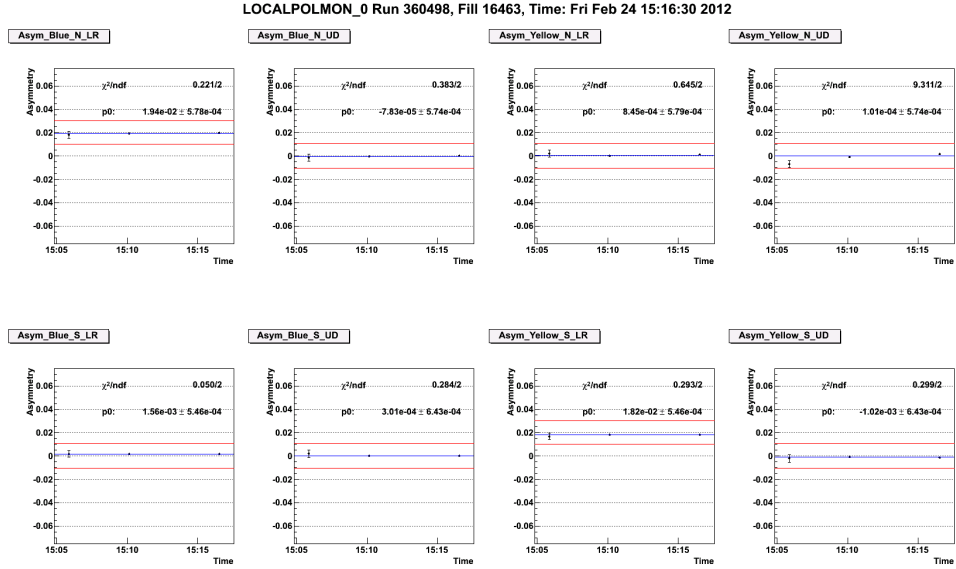

Figure 6: Local polarimetry data from fill: 16463, runnumber: 360498. The next fill where the sign of the local polarimeter asymmetry matches our expectations

2.3.3 Runs 367538 and 367598

The following discussion covers two runs: 367538 and 367598, whose crossing shift did not align the experimental yields with the spin pattern/GL1p yields. Figure 7 show the experimental yields for the respective two runs; figure 8 shows the spin database entries for each of the runs.
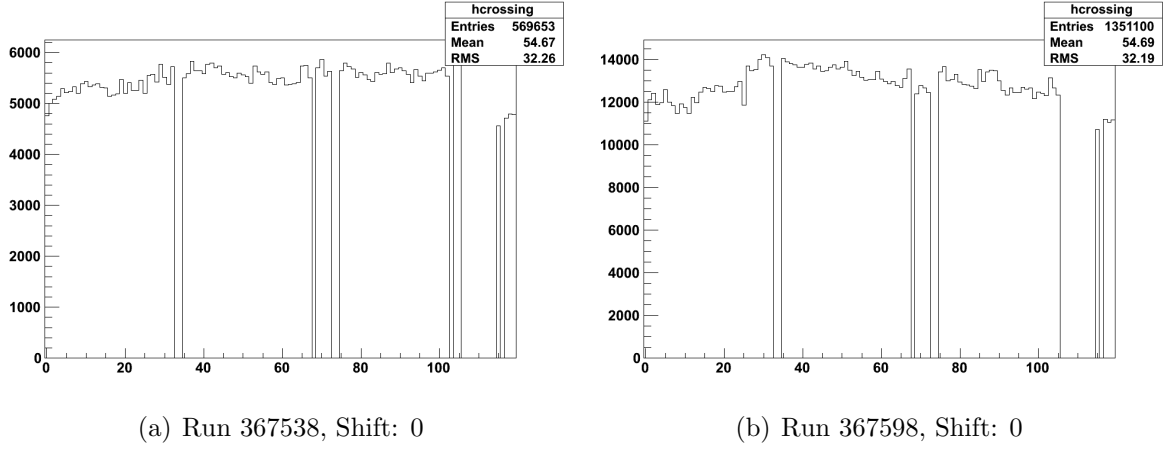

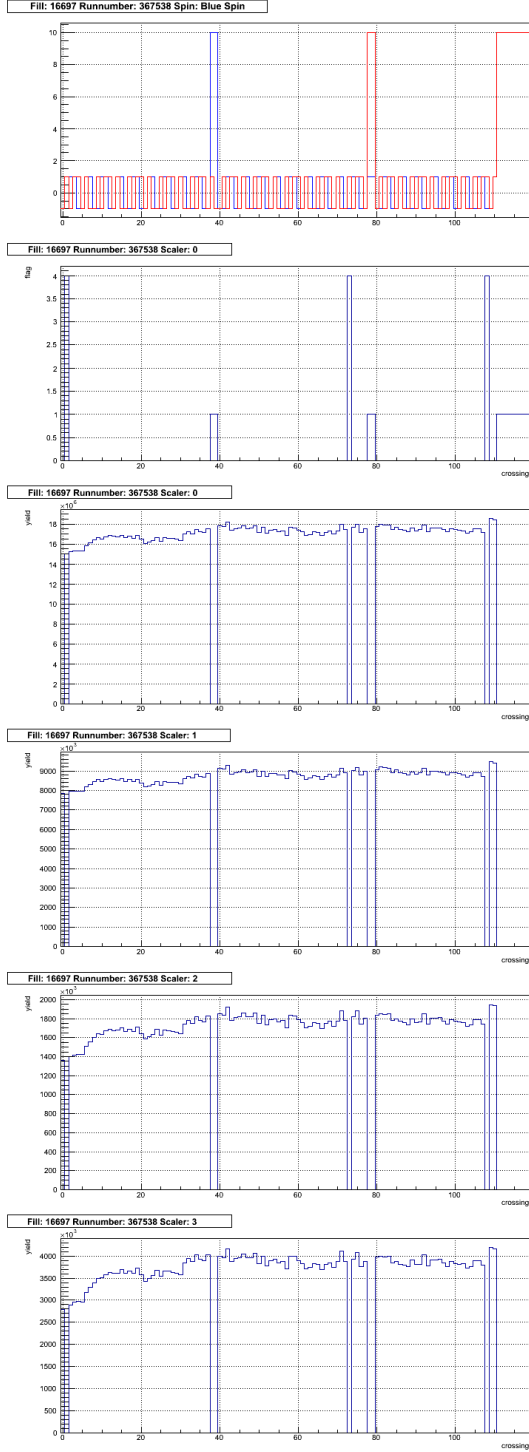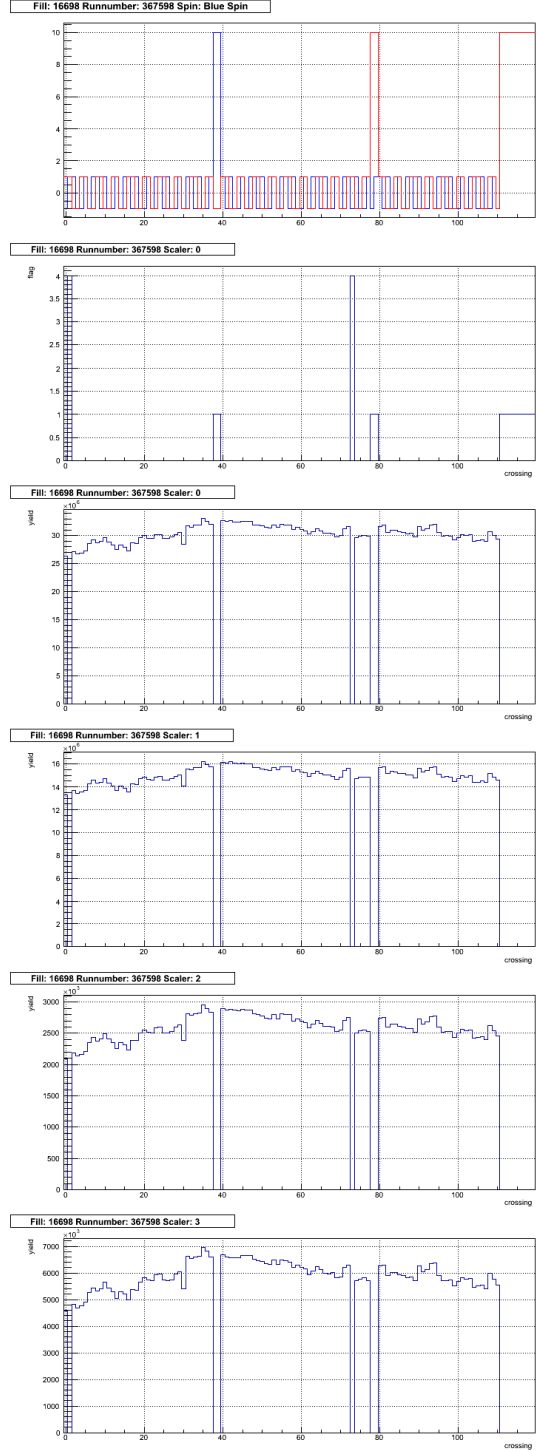
(a) Run 367538, Shift: 0

(b) Run 367598, Shift: 0

Figure 7: Distribution of experimental counts versus crossing for two runs. The experimental yields follow the pattern of a fill with a crossing-shift of 5, but the database indicates that the value is 0.

(a) Run 367538, Shift: 0   (b) Run 367598, Shift: 0

Figure 8: Spin database contents for two runs. The crossing shift is incorrectly entered as 0.

2.4   Scalers

The final check examined the scaler data. This analysis noticed the crossing-shift errors noted in the previous section and a problem in a few runs with the GL1p scaler values. These runs are all from the 510 GeV portion of the run. The runs in question do not exhibit the usual abort gap structure and the value of scalers appears spurious. We recommend removing these runs from analysis:

365513 367159 367313 367735

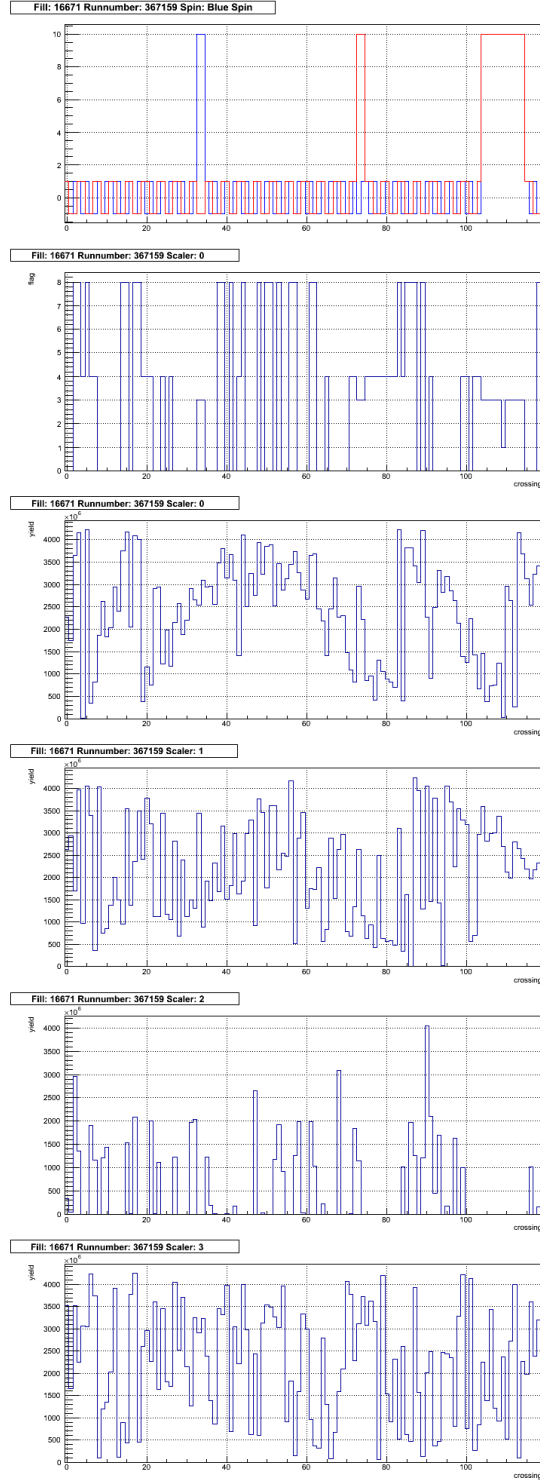An example of one of these run's scaler values are shown in figure 9.

Figure 9: A graphical representation of spin database information from runnumber 367159. From top to bottom: spin pattern, a runqa flag (which will not be explained), scaler 0-3 counts from the GL1p. The horizontal axis in all plots is the crossing id. In the spin pattern plot, unfilled-unfilled crossings are marked with a 10. Based on the lack of abort-gap structure, it appears that the GL1p readout was flawed for this runs.

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3 Summary

In summary, we have analyzed the 2012 spin database entries. Where possible we have corrected problems, and where not possible we have listed runs to exclude from analysis.

The runs to exclude from analysis are:

```
358661 358663 358665 358667 359060
359061 359062 359064 362260 365513
367159 367313 367735
```

In addition, the fills listed in table 1 were not assigned official polarization values. In the case of double spin asymmetries, these fills are useless; in the case of single spin asymmetries, only single beam analyses are possible. Finally, the following runs may have a problem with the PPG event firing during physics crossings:

```
358985 358986 358988 358991
```

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References

[1] RHIC Spin Group, `https://wiki.bnl.gov/rhicspin/Run_12_polarization` accessed Jan. 15, 2013.